**REMARKS**

**Title.** The Examiner objected to the title. The title is amended as suggested by the Examiner.

**Drawing.** The drawing was objected to for lacking the reference numeral "280," indicating fluorine ions, that appeared in the text. The specification is now amended to remove all instances of "280" and to make clear that the inclined arrows in Fig. 3C indicate the fluorine ion implantation (and therefore also the ions) discussed in the text. The requirement for a drawing change is respectfully traversed for the record, on the basis that an ion is too small to be illustrated by any drawing representation, and reference number 280 referred to a single ion.

**Obviousness of Claims 5-8**. Claims 5-8 were rejected under § 103 over Burgener '823 in view of Duffy '574. Burgener is relied upon for teaching in col. 6 all of the subject matter of rejected claim 5, except for that recited in the middle (third) paragraph ("forming a metal oxide film ..."). Duffy is relied upon for the teaching of that paragraph. This rejection is respectfully traversed.

**The Applicant's** prior art includes a triangular shape at the edge of a silicon layer (shown inside circle 135 in Fig. 2E). This triangular shape has had a bad effect on device characteristics (page 2, third full paragraph), and the Applicant discloses prior-art attempts to overcome the bad effect, such as changing the edge shape (e.g., page 3, line 3 of second full paragraph). However, these attempts had drawbacks. The Applicant's solution is recited in the claims.

**Motivation.** A key issue is motivation for combining the references; with respect, neither of the references teaches toward their combination.

Among the Applicant's objects is controlling leakage currents (see page 4, line 8), and this is also the object in Burgener, which discloses that "controlling ... edge transistor leakage" is an object (col. 3, lines 42). But Burgener teaches to do this by a technique completely different from that of the Applicant.

Burgener emphasizes controlling the diffusion of boron (col. 2, lines 19-36), which is accomplished by reducing the boron dose (col. 2, lines 37-59), and this in turn is accomplished by the use of contact potentials (discussed below). Burgener states (col 7, line 56), "By fabricating MOSFET's in substantially pure silicon ... only minimal concentrations of dopant atoms (if any) are present, thereby eliminating parasitic charge and the associated degradations." Parasitic charge is also a concern for the Applicant (page 1, lines 8 and 14; page 4, line 9).

**Contact Potentials and Edges.** Burgener uses contact potential to replace doping. At col. 8, line 57, Burgener states, "Use of metal work function[1] ... to set threshold voltage has [advantages] .... Surface channel transistor behavior occurs when conduction occurs ... at the interface between the gate insulator 40 and the silicon films 44 and 54" (see Fig. 2D).

However, this teaching by Burgener relates only to the central portion of the transistor shown in Fig. 2. Burgener does not disclose putting any metal oxide film at the edge (e.g., at the curved end of silicon layer 42D or 52S in Fig. 2D). While controlling edge transistor leakage is an object of Burgener, Burgener does nothing *at the edge* to control the threshold characteristics of a parasitic transistor, which is contrary to the Applicant's amended claim 5.

What Burgener *does* put at the edge is layer 62 (see Fig. 2E), which is described as only an "insulating layer" and is disclosed to have no other function than insulating. In view of Burgener's use of contact potentials as the very basis for its invention, its silence as to contact potential due to the insulating layer 62, that covers the edge of the silicon layer, is seen to teach against the Applicant's amended claim 5.

It is noted that "insulation" is much broader than the claimed "metal oxide," and there is no anticipation of the Applicant's metal oxide at the edge of a silicon layer.

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[1] Burgener's "work function" is seen to be the same as the "fixed electric charge" used in the claims and the rejection (page 3, 4th line from the bottom), and both are taken to mean a contact potential.

In sum, while one of Burgener's objects is "precise control over the edge of a MOSFET" (Abstract), it is clear that Burgener does not achieve this object by putting a metal oxide at the edge, or by controlling the threshold characteristics at that position. Thus, Burgener does not disclose the feature claimed by the Applicant, and it teaches away from the instant claims by presenting a *different* way of achieving the *same* object.

**Burgener Teaches No Need for Modification.** Burgener asserts that "a device constructed in accordance with this invention contains only the dopant atoms necessary to induce surface channel conduction and to set threshold voltage. Therefore, *none* of the other parasitic charges found in traditional MOSFET's are present. The present invention thereby minimizes the dopant charge" (col. 9, line 11; emphasis added). This statement by Burgener, that *all* of the parasitic charges are removed by its invention, would lead the person of ordinary skill to conclude that no improvement is needed (or indeed possible), and therefore the person of ordinary skill would not have combined Burgener with any other reference, in order to achieve the objects taught by Burgener.

**Duffy.** The Examiner asserts that Duffy teaches the use of contact potential to eliminate bias. This assertion is respectfully questioned. In the applied text, Duffy discloses "loss tangent measurements ... with zero gate bias. Because of the negative fixed oxide potential [contact potential] the surface of *p* type substrates is normally in accumulation at zero gate bias." It appears to the Applicant that, as the contact potential is "fixed," the gate bias must be an adjustable parameter of the Boonton bridge device. The Boonton device does not measure contact potential, it measures capacitance and conductance (col. 6, lines 45-48), which in turn are used to calculate the loss tangent measurement (col. 6, line 54).

**Official Notice Is Traversed.** The Examiner asserts (page 4, line 2) that eliminating bias is a known problem, and takes official notice of this teaching. In view of the Applicant's questions regarding what Duffy means by "bias," and the fact that this assertion is critical to the

rejection (Action at page 4, line 10), the Applicant respectfully traverses official notice and requests that the Examiner supply a reference showing what the rejection asserts, that bias is a known problem in isolation.

**Obviousness of Claims 9, 10, 12, and 13**. Claims 9, 10, 12, and 13 were rejected under § 103 over Burgener '823 in view of Nishioka. This rejection is respectfully traversed.

The Examiner relies on Nishioka for teaching implanting of impurities. However, Burgener actively teaches *against* ion implantation, stating that "it is preferable that the source and drain regions [e.g., 42S and 42D, Fig.2] be formed by diffusion doping .... Diffusion doping has several advantages over ion implantation ..." (col. 7, lines 18 and 34). Because of this teaching, the person of ordinary skill would never had combined Burgener with Nishioka, absent some other, compelling, motivation.

With respect, such compelling motivation is lacking. The Examiner states that Nishioka teaches ion implantation for hardening against radiation, but Burgener is not seen to teach any need for radiation hardening, and the Examiner has pointed out no such teaching.

As to the alternate motivation, namely, bias (page 7, line 1), this is respectfully traversed on the basis that Nishioka's applied abstract actually teaches that "radiation-induced leakage currents of reverse-biased $n^{+}$p-junction diodes are suppressed," which is seen to relate only to radiation-induced currents and no others; to relate only to $n^{+}$p-junction diodes and not to silicon/metal oxide junctions; and furthermore to relate only to reverse-biased $n^{+}$p-junction diodes, which are unrelated to the claims of the Applicant or to the fixed voltage of a contact potential.

**Obviousness of Claim 11.** Claim 11 was rejected under § 103 over Burgener '823 in view of Nishioka and Chen. This rejection is respectfully traversed.

As noted above, Burgener teaches against any ion implantation, whether slanted or not. The Examiner asserts that the person of ordinary skill would have added Chen to the asserted combination because Chen's ions impact on a slanted surface.

However, there is only one slanted surface in applied Fig. 3b, and the crossed arrows indicate that the ions can travel generally parallel to, as well as perpendicular to, the surface; thus Chen also teaches against ions perpendicular to the surface, and clarification is requested. Chen's stated purpose of the slanted ion beams (col. 6, lines 13-44) is unrelated to the inclination of the surface.

No teaching about ions hitting an inclined surface is seen, and no citation is given. A citation is requested.

The only slanted surface in applied Fig. 3b is not in a field oxide film, it is in a "field insulating region" 52. The layer 54, which is of the same stuff as layer 52 (by the drawing), is "electrical insulator but could consist of metal or semiconductor on an electrical insulator" (col. 5, line 34).

**The new claims** recite an inclined edge and irradiation generally perpendicular to that edge (in claim 16). These features are believed not to be disclosed. As argued just above, Chen is believed not to disclose the subject matter of new claim 15.

Respectfully submitted,

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May 31, 2005
Date

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